

## SENSOR-EQUIPPED DISPLAY DEVICE AND SENSOR DEVICE

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2015-185395, filed Sep. 18, 2015, the entire contents of which are incorporated herein by reference.

### FIELD

[0002] Embodiments described herein relate generally to a sensor-equipped display device and a sensor device.

### BACKGROUND

[0003] Recently, a sensor-equipped display device comprising a sensor (often called a touch panel) capable of detecting contact or approach of an object, has been put into practical use. As an example of the sensor, a capacitive sensor capable of detecting contact or approach of an object, based on a variation in electrostatic capacitance is well known. A detection electrode and a sensor driving electrode constituting the sensor are disposed in a display area in which images are displayed, and opposed to each other with a dielectric interposed between the electrodes. The detection electrode is electrically connected to a lead line located outside the display area.

[0004] Requests for downsizing of the display device are increased while the display area is extended, and a periphery outside the display area tends to become a narrow frame. For this reason, the sensor driving electrode and the lead line are often disposed closely to each other. In this case, the lead line may function as a sensor due to capacitive coupling between the sensor driving electrode and the lead line. For example, if an object which is to be detected contacts or approaches the vicinity of an outermost periphery of the display area, variation in the electrostatic capacitance of the lead line is detected. For this reason, the detection electrode connected to the lead line performs error detection as if the detection electrode detected the detected object at a position different from a position where the detection electrode should detect the detected object.

[0005] Thus, for example, a technology of disposing a grounded conductive material outside the display area between the sensor driving electrode and the outer peripheral line (lead line) and blocking the capacitive coupling between the sensor driving electrode and the outer peripheral line has been proposed.

### SUMMARY

[0006] The present application generally relates to a sensor-equipped display device and a sensor device.

[0007] According to one embodiment, a sensor-equipped display device includes a display panel which includes a sensor driving electrode disposed in a display area for displaying an image, detection electrodes each including a body portion opposed to the sensor driving electrode in the display area and a broadened portion connected to the body portion and formed to be wider than the body portion, and a lead line disposed in a non-display area outside the display area and electrically connected to the broadened portion. The broadened portion is disposed in the non-display area without being overlaid on the display area in planar view.

[0008] Additional features and advantages are described herein, and will be apparent from the following Detailed Description and the figures.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a perspective view schematically showing a configuration example of a sensor-equipped display device of one of embodiments.

[0010] FIG. 2 is a view schematically showing a basic configuration and an equivalent circuit, of the liquid crystal display device DSP shown in FIG. 1.

[0011] FIG. 3 is an equivalent circuit diagram showing one of pixels PX shown in FIG. 2.

[0012] FIG. 4 is a cross-sectional view schematically showing in part a structure of the liquid crystal display device DSP.

[0013] FIG. 5 is a plan view schematically showing a configuration of the sensor SE of the present embodiment.

[0014] FIG. 6 is a plan view enlarging and schematically showing a part of the sensor SE shown in FIG. 5.

[0015] FIG. 7 is a cross-sectional view schematically showing a structure of a display panel PNL including a part of the sensor SE shown in FIG. 6.

[0016] FIG. 8 is an illustration for explaining a principle of an example of a sensing method.

[0017] FIG. 9 is another plan view enlarging and schematically showing a part of the sensor SE shown in FIG. 5.

[0018] FIG. 10 is yet another plan view enlarging and schematically showing a part of the sensor SE shown in FIG. 5.

[0019] FIG. 11 is yet another plan view enlarging and schematically showing a part of the sensor SE shown in FIG. 5.

[0020] FIG. 12 is yet another plan view enlarging and schematically showing a part of the sensor SE shown in FIG. 5.

[0021] FIG. 13 is a plan view schematically showing another configuration of the sensor SE of the embodiment.

### DETAILED DESCRIPTION

[0022] In general, according to one embodiment, a sensor-equipped display device, includes: a display panel which includes a sensor driving electrode disposed in a display area for displaying an image, detection electrodes each including a body portion opposed to the sensor driving electrode in the display area and a broadened portion connected to the body portion and formed to be wider than the body portion, and a lead line disposed in a non-display area outside the display area and electrically connected to the broadened portion; and a driving module which supplies a sensor drive signal to the sensor driving electrode, allows the sensor drive signal from the sensor driving electrode to be detected as a detection signal by each of the detection electrodes, and reads variation of the detection signal via the lead line, the broadened portion being disposed in the non-display area without being overlaid on the display area in planar view.

[0023] According to another embodiment, a sensor device opposed to a display device including a display area for displaying an image and a non-display area outside the display area, the sensor device includes: a sensor driving electrode opposed to the display area; detection electrodes each including a body portion opposed to the sensor driving electrode and a broadened portion connected to the body